

JCCEM CONTAMINANT TRANSPORT STUDIES

TECHNOLOGY NEED

The Joint Coordinating Committee for Environmental Restoration and Waste Management (JCCEM) facilitates the exchange of technologies for characterizing and monitoring contaminant transport in the environment between the United States and the Former Soviet Union (FSU) countries under the Peaceful Use of Atomic Energy Act. Existing DOE contaminant transport models need to be validated through the exchange of contaminant-migration data and joint United States-Russian modeling of well-characterized contaminated sites. The results of this validation will help DOE site managers determine the optimum number of samples and wells needed to characterize a contaminated site. This information will be used to obtain approval from regulators for fewer wells and sample analyses and to develop stronger cases for No Further Action (NFA) at many DOE sites.

TECHNOLOGY DESCRIPTION

Nuclear fuel cycle activities of the FSU have resulted in significant contamination of the environment in western Siberia. The West Siberian Basin contains the largest amounts of surface and subsurface radioactive contaminants on earth. Pacific Northwest National Laboratory (PNNL) is developing, jointly with their Russian counterparts in the Ministry of Atomic Energy of the Russian Federation (MINATOM), three-dimensional (3-D) models of the hydrogeology and potential contaminant migration in the West Siberian Basin to verify and validate DOE models and modeling strategies using decades of data from measured contaminant migration at the Mayak, Seversk (Toms-7), and Zhleznogorsk (Krasnoyarsk-26) sites. These joint models will also be used in designing mitigation strategies for the sites, DOE uses such models to evaluate the potential for risk from contaminated U. S. sites, and will benefit both from model validation and from technologies transferred from Russian site remediation work.

The long-term goal of this work is to determine and improve the capability of DOE's contaminant transport models to predict future environmental and human impacts of radioactive contaminant releases, such as those that have occurred to date in the West Siberian Basin. Our objectives for FY 1998 are to (jointly with our Russian colleagues):

- Publish results of the joint United States–Russian hydrogeologic contaminant-transport model intercomparison studies for Mayak.
- Develop and calibrate a 3-D computer model of the regional hydrogeology of Mayak.
- Develop the characterization data and conceptual models necessary to begin development of a 3-D computer model of the regional hydrogeology of the Seversk Site in FY 1999 (or later).

BENEFITS

- Technical collaboration with FSU states and scientists on large-scale groundwater contaminant migration.
- Validation of groundwater transport models of DOE scientists with decades of Russian groundwater sampling data will improve risk assessments, and remediation plans, increase stakeholders confidence, and potentially lower site characterization and remediation costs at DOE sites.

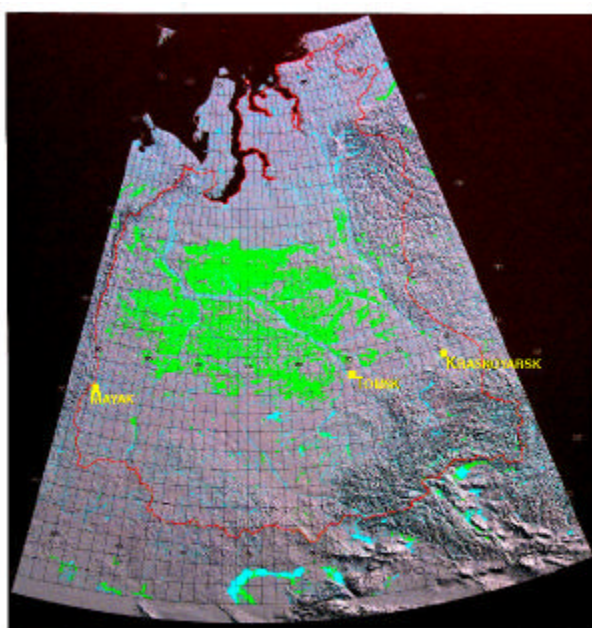
COLLABORATION/TECHNOLOGY TRANSFER

Technical expertise from the United States, including joint activities by PNNL and Savannah River Technology Center, is being brought to bear on large-scale groundwater contaminant migration.

ACCOMPLISHMENTS

- Completed the regional hydrogeologic model for the West Siberian Basin and published a definitive synopsis in May 1995. This is, to our knowledge, one of the largest geographic areas ever attempted for modeling, and is the proof-of-principle for the systematic approach to remote/local site characterization and analysis that is the basis of our technology. Russian peer review of this effort in August 1995 was very positive and led to PNNL developing the joint United States-Russian geographic information system database for all subsequent modeling of the Mayak, Seversk, and Zheleznogorsk sites.

- Completed the Mayak contaminant-transport model intercomparison study, in which PNNL and Russian modelers compared results of their analyses of a two-dimensional problem representative of the Lake Karachai contaminant plume. The results of this study were published in 1998.
 - "Modeling Intercomparison Study to Investigate a Dense Contaminant Plume in the Complex Hydrogeologic System Around Lake Karachai, Urals: Part 1. Hydrogeologic Features and Problem Formulation." (Submitted to Advances in Water Resources)
 - "Modeling Intercomparison Study to Investigate a Dense Contaminant Plume in the Complex Hydrogeologic System Around Lake Karachai, Urals: Part 2. Comparison of Model Results." (Submitted to Advances in Water Resources)
- Completed camera-ready copy of edited English translation of Russian book entitled Deep Injection Disposal of Radioactive Waste in Russia for publication by Battelle Press.
- Completed joint United States-Russian conceptual model for the 3-D Mayak hydrodynamic and contaminant-transport models; model calibration to be completed by the end of 1998.



**Regional JCCM Contaminant Transport Study
in the West Siberian Basin of Russia**



**Russian driller and American
researcher installing the Strata
Sampler™ during the Third Mayak
Field Study.**

Bibliography of Key Publications:

- Foley, M.G., D.J. Bradley, C.R. Cole, K.A. Hoover, M.D. Williams, J.L. Devary, J.P. Hanson, L.G. McWethy, W.A. Perkins, and S.K. Wurstner. "West Siberian Basin Hydrogeology-Regional Framework for Contaminant Migration from Injected Wastes," *Deep Injection Disposal of Hazardous and Industrial Wastes*. Eds., J.A. Apps and C-F Tsang. Academic Press (1996).
- Foley, M.G., D.J. Bradley, C.R. Cole, J.P. Hanson, K.A. Hoover, W.A. Perkins, and M.D. Williams. *Hydrogeology of the West Siberian Basin and Tomsk Region*. PNL-10585. PNNL, Richland, WA (1995).

- Foley, M.G., C.R. Cole, C.D. Gullett, M.D. Williams, L.J. Alexander, and J.C. Bennett. "Letter Report-PNL FY95 Local-Modeling Activities for the Tomsk Site, West Siberian Basin," PNL, Richland, WA (September 1995).
- Hoover, K.A., M.G. Foley, E.A. Allen, and J.B. Topping. "Letter Report - PNL FY 1995 Local-Modeling Activities for the Mayak Site, West Siberian Basin," PNL, Richland, WA (September 1995).
- Hoover, KA, M.G. Foley, E.A. Allen, L.J. Alexander, and M.I. McKinley. *West Siberian Basin Hydrogeology: Site Characterization of Mayak, Tomsk-7 and Krasnoyarsk-26*. PNNL-11457, Pacific Northwest National Laboratory, Richland, Washington. (1997)
- Williams, M.D., C.R. Cole, M.G. Foley, K.A. Hoover, and L.J. Alexander. *Development of A Three-Dimensional Regional Hydrogeologic Model of the Mayak Site, Urals*. Letter Report, Pacific Northwest National Laboratory, Richland, Washington (September 1997).

TECHNICAL TASK PLAN (TTP) INFORMATION

TTP No./Title: RL35C223 - JCCEM Contaminant Transport Studies (PNNL)

CONTACTS

Michael Foley
Principal Investigator
Pacific Northwest National
Laboratory
P.O. Box 999, MS K8-41
Richland, WA 99352
(509) 372-4671 fax: -4412
e-mail: mike.foley@pnl.gov

John Neath
Technical Program Officer
U.S. Department of Energy
Richland Operations Office
P.O. Box 550, MS K8-50
Richland, WA 99352
(509) 372-4876 fax: -4549
e-mail: john_p_neath@rl.gov